

L E T T E R

FROM

THE SECRETARY OF THE INTERIOR,

TRANSMITTING,

*In response to Senate resolution of August 29, the effect upon certain rivers
in Colorado of the diversion of water for irrigation.*

FEBRUARY 18, 1889.—Referred to the Select Committee on Irrigation and Reclamation of Arid Lands and ordered to be printed.

DEPARTMENT OF THE INTERIOR,
Washington, February 16, 1889.

SIR: I have the honor to acknowledge the receipt of a resolution adopted by the Senate on the 29th of August, 1888, of which the following is a copy, to wit:

Resolved, That the Secretary of the Interior be directed to inquire and report to the Senate at its next session the extent to which the diversion of the waters of the Platte and Arkansas Rivers and their tributaries in Colorado for irrigation and other purposes affects the flow of the waters of those streams in the lower valleys, and especially during the growing season, and whether in his opinion the title conveyed by the Government to lands fronting on said streams covers the privilege of diverting water therefrom beyond that necessary for use thereon for irrigation and mining purposes, and to report what action is needed to protect the rights of riparian owners along the waters of said streams in the States of Kansas and Arkansas, and what measures can be devised to increase the flow of water in those streams during such season.

And in response thereto to transmit herewith a copy of a communication of the Commissioner of the General Land Office, under date of December 8, 1888, and also a copy of a communication from the Director of the Geological Survey under date of February 8, 1889. The resolution of the Senate was referred to the Commissioner of the General Land Office and to the Director of the Geological Survey for report on the 1st of September, 1888, but the reply of the Director has been delayed.

I have the honor to be, very respectfully,

WM. F. VILAS,
Secretary.

The PRESIDENT PRO TEMPORE OF THE SENATE.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., February 8, 1889.

SIR: I have the honor to acknowledge the receipt of the following Senate resolution, with instructions indorsed thereon:

IN THE SENATE OF THE UNITED STATES,
August 29, 1888.

Resolved, That the Secretary of the Interior be directed to inquire and report to the Senate at its next session the extent to which the diversion of the waters of the Platte and Arkansas Rivers and their tributaries in Colorado for irrigation and other purposes affects the flow of the waters of those streams in the lower valleys, and especially during the growing season, and whether in his opinion the title conveyed by the Government to lands fronting on said streams covers the privilege of diverting water therefrom beyond that necessary for use thereon for irrigation and mining purposes, and to report what action is needed to protect the rights of riparian owners along the waters of said streams in the States of Kansas and Arkansas, and what measures can be devised to increase the flow of water in those streams during such season.

Attest.

ANSON G. MCCOOK,
Secretary.

[Indorsement.]

DEPARTMENT OF THE INTERIOR,
September 1, 1888.

Copy. Respectfully referred to the Director of the U. S. Geological Survey, with request that he will make the inquiry as required by the resolution, as to the extent and effect of the diversion of the waters of the streams specified, and what measures can be devised to increase the water in such streams, and report the result to this Department.

WM. F. VILAS,
Secretary.

In compliance with the above instructions, the following brief preliminary report is submitted:

It is not possible to report fully and satisfactorily on the subject at the present stage of its investigation, as accurate observations have not yet been made to a sufficient extent to give good quantitative results. The work of the survey of the arid lands now in progress will ultimately give good data for the solution of the problem, and at such time it is probable that a satisfactory report can be made.

REPORT.

The Platt and the Arkansas have their sources in the mountains of Colorado and Wyoming, but after passing the Colorado and Wyoming lines they receive great additions to their volumes from the storms and streams of the lower country; so that but a small portion of the water which these rivers discharge into the Missouri and Mississippi comes from the mountain regions. In Colorado and Wyoming all agriculture is dependent upon artificial irrigation, as the water which comes direct from the heavens to the agricultural lands is insufficient to produce crops. The same is true of the western portion of Kansas and Nebraska. In this portion of the arid region under consideration, embracing a part of Colorado, a part of Wyoming, a part of Nebraska, and a part of Kansas, agriculture is possible only by diverting the water of the streams out upon the adjacent lands; and the real question is this: What effect will the development of irrigation in Colorado and Wyoming have upon irrigation in Nebraska and Kansas? The North Platte, the South Platte, and the Arkansas present distinct problems; they must therefore be considered separately in this statement.

THE NORTH PLATTE.

The Platte has two branches, the North Platte draining a large area in Wyoming, the South Platte a large area in Colorado. Much of the region drained by the North Platte in Wyoming is at so great an elevation above the sea that agriculture can not be made profitable, that is, the climate is too cold and the season too short to cultivate a profitable series of crops; but some portions of the Wyoming region lie at lower altitudes, where profitable agriculture can be carried on. The area of such lands, however, is not sufficient to utilize all the waters of the North Platte. Ultimately a large volume of this water can be used across the line in Nebraska to better advantage than in Wyoming, and the storage of the waters of the North Platte, which will be chiefly in Wyoming, will greatly benefit Nebraska, in fact, Nebraska is far more interested in the storage of the waters of the North Platte than Wyoming, for in general the storage of the waters of the North Platte will benefit Wyoming to a very slight degree. It must be understood that irrigation can be practiced without storage by using the waters of the running streams during the season of irrigation, which is very short, usually averaging for various crops about two months in this region. Storage increases the area of irrigable lands by holding back in reservoirs the water that would otherwise run to waste during ten months of the year. It is this water, to be stored about the headwaters of the North Platte, by which the people of Nebraska are to be chiefly benefited.

THE SOUTH PLATTE.

The South Platte has its source in the mountains of Colorado. In that State irrigation is already greatly developed, so that practically all the water of the South Platte which flows from the mountains during the season of irrigation is already used in critical seasons. Whether this water should be surrendered by the people of Colorado to the people of Nebraska—whether the agricultural industries along the Platte and its tributaries in Colorado should be destroyed in order that new industries in Nebraska may be created, is a question that every one can easily answer for himself. But there is a further condition worthy of consideration. If the waters of the South Platte now used in Colorado were used in Nebraska, the area brought under cultivation in the latter State would be very much smaller than the area now under cultivation in Colorado by the use of the same waters.

This fact results from well-known physical conditions. In that arid region the rain is condensed on the mountains; comparatively little falls on the arid plains, not enough to produce perennial streams. When the waters debouch from the mountains into the plains their channels are radically changed; they are narrow, deep, and clear; where they run across the plains they are wide and shallow, and their waters are loaded with mud. The muddy waters are spread out below in wide channels of sand. A stream may be several hundred yards wide and only a few inches deep. The waters permeate these sands, and a large portion is evaporated; so that a stream steadily diminishes in volume from the mountains across the arid plains until a more humid region is reached, where it again increases in size. It is for this reason that the waters of the South Platte will irrigate a much larger area in Colorado near the mountains than in Colorado near the Nebraska line; and the area which they will irrigate in Nebraska is still smaller.

It is probable that 3 acres can be irrigated near to the mountains of

Colorado where only 1 acre can be irrigated in Nebraska. This must be understood, however, as an estimate, and not as actually determined by stream gauging.

The waters of the South Platte flowing during the irrigating season are already substantially used near to the mountains, and the important question to be determined is what effect will storage have upon the supply of water from this stream? It has already been stated that the waters of the North Platte can be advantageously and economically stored in the mountain region, but this is not true of the South Platte. With some important exceptions the waters of the South Platte must be stored below, as the declivity of the mountains drained by that river is in general too great to afford favorable places for their storage; they will therefore have to be stored in the foot hills and on the plains.

All of this stored water will decrease the volume of the South Platte where it crosses the Colorado-Nebraska line during the non-irrigating season. But when the mountain waters of the non-irrigating season are stored in this manner and poured upon the lands of Colorado and used for agricultural purposes, a part of this stored water will be evaporated to the heavens, but another part—and a large part—will be returned to the Platte, where it can be recovered and again carried to the irrigable lands farther down the stream in eastern Colorado and western Nebraska. This general statement may therefore be made: The use of the water which falls as rain during the irrigating season near to the mountains in Colorado, as it is now chiefly used, greatly diminishes the volume in western Nebraska; but, on the other hand, the storage of water during the non-irrigating season to be used during the irrigating season will greatly increase the water available for Nebraska during the irrigating season. Taking the facts as they are, namely, that the waters of the South Platte falling during the irrigating season are already used in Colorado, the prospect for irrigation from the South Platte in western Nebraska depends upon the storage of the waters falling during the non-irrigating season. The greater the amount of water stored in Colorado the greater will be the area irrigated in Nebraska.

THE ARKANSAS.

The waters of the Arkansas that flow during the irrigating season are partly used in Kansas, but chiefly in Colorado; so that already in critical seasons the river runs dry near the Colorado-Kansas line. The future development of irrigation in the valley of the Arkansas therefore depends chiefly upon the storage of water. This storage can be accomplished with advantage, in fact with great economy, in the mountain regions of Colorado. Along the headwaters of this stream in the mountains there are many mountain meadows and morainal valleys where lakes can be created to store large bodies of water at small expense. When the waters of these mountain streams are stored in the upper regions, where they are comparatively clear, the reservoirs have a permanent value, from the fact that they will not be speedily filled with sediment; but if reservoirs be constructed below on the plains, and the rivers taken out where they are muddy and excessively muddy, as is the case with the Arkansas, the storage basins will be speedily filled with sediment and destroyed. If stored on the plains, as in the case of the South Platte, the waters must be diverted from the natural channels where they debouch from the mountains and carried in canals to the storage basins. This adds greatly to the expense of storage,

But there is another consideration affecting this question of great importance. In the lowland reservoirs the evaporation from the surface would be 50 to 75 inches, and the lowland reservoirs would therefore lose a large body of water in this manner, while in the highland reservoirs the evaporation would probably be not greater than 25 inches, and might often be less. Whenever highland reservoirs are possible the waters must be stored in the upper regions, and these conditions control in the case of the Arkansas River. The waters of the Arkansas can not be taken out within the boundaries of the State of Kansas and stored in reservoirs, from the fact that they contain so much silt that the reservoirs would be speedily obliterated. The flow of waters in the irrigating season is already provided for. All additional irrigation from these waters would be so small that all State interests may be neglected.

The irrigating season on this river is, on an average, something more than two months, while the waters run to waste for more than nine months. It is this waste water that is to be stored in the mountains. Whatever is thus stored will decrease the volume passing the Kansas-Colorado line during the non-irrigating season, but will greatly increase the volume passing that line during the irrigating season; and, as in the case of the South Platte, the prospect for irrigation in western Kansas depends upon the storing of water in Colorado. The greater the storage the greater will be the area irrigated in Kansas.

It must be understood that in the above statement the primary facts and principles have been set forth and general results given. Exact quantitative results can not be given at this stage of the investigation; but if the work of the irrigation survey is continued until the survey is completed, practical quantitative results will be afforded.

When the investigation was begun under the instructions of the Secretary, I had not carefully considered the subject, and had made no collection of the available facts relating thereto; and I supposed that the waters of the South Platte and of the Arkansas falling in Colorado would be wholly or chiefly utilized in Colorado; and I reasoned in this manner from the consideration that the people of Colorado are already engaged in these industries, and are more likely to speedily develop irrigation industries than are the people in Kansas and Nebraska. But there was another consideration which engrossed my attention for the time. On the arid plains no perennial streams are born. The water which falls from the heavens is in the main evaporated back to the heavens, though when great storms, fall storm-waters, collecting for a few hours or a few days at most, flow into the perennial streams that head in the mountains and cross the plains; and I suppose that like results would follow from the spread of irrigating waters on the lands. But experience in California, in Utah, in Colorado, and on the Gila in Arizona abundantly exhibits the fact that the waters used in irrigation are but partially evaporated, and that a very large quantity finds its way again to the streams. It is thus that the facts of experience have modified preconceived hypotheses.

Ultimately a very large area in Kansas and Nebraska will be irrigated by impounding the local storm-waters of that region, and the topographic conditions are very favorable for such enterprises. But besides the irrigation which it is possible to accomplish through the impounding of storm-waters, considerable areas will be irrigated through the utilization of the waters of the North Platte, the South Platte, and the Arkansas—all contingent, however, upon the condition that the waters of these streams be stored above.

It must be remembered that the Upper Arkansas, the North Platte, and the South Platte are not navigable streams. They are all exceedingly broad, muddy rivers, having great declivity, and so shallow as to be practically impassable for even canoes during the greater part of the year. They are thin sheets of mud tumbling down a highly-inclined plane; so that the interests of navigation are in no way affected by the use of these streams for agriculture.

The use of these streams for agricultural purposes will have no practical effect upon their uses as powers in Kansas and Nebraska. Because of the great amount of sediment which they carry, they have little value as powers; for if hydraulic works were constructed along their upper courses it would be at an enormous expense, on account of their great width and because they run through vast accumulations of sand; and if the streams were dammed and ponds created they would speedily be filled by the enormous inflow of sand. There is yet a further consideration. The rain which falls in Kansas and Nebraska furnishes a sufficient volume of water for the Platte and Arkansas alike for all possible prospective use as mechanical powers.

From the above statement it will appear that the question of the use of the Platte Rivers and of the Arkansas is one affecting agriculture only, and that the amount of irrigable lands redeemed in Nebraska and Kansas by the waters of the Platte and Arkansas depends upon the amount of water stored in Colorado and Wyoming.

I am, with great respect, your obedient servant,

J. W. POWELL,
Director.

The SECRETARY OF THE INTERIOR,
Washington, D. C.

DEPARTMENT OF THE INTERIOR,
GENERAL LAND OFFICE,
Washington, D. C., December 8, 1888.

SIR: I have the honor to return herewith the resolution of the Senate of the United States of August 29, 1888, which you referred to me on the 1st September, 1888, with a request for the expression of my views "upon the inquiry as to whether the title conveyed by the Government to land bordering on the streams specified conveys the privilege of diverting water therefrom beyond what is necessary for use thereon for irrigation and mining purposes, and what action is necessary to protect the rights of riparian owners along the waters of said streams in Kansas and Nebraska."

This resolution refers to the diversion of the waters of the Platte and Arkansas Rivers and their tributaries for irrigation and other purposes, in Colorado, and inquiries, 1st, to what extent such diversion affects the flow of the waters of those streams in the lower valleys, and especially during the growing season; 2d, whether the title conveyed by the Government to lands fronting on said streams covers the privilege of diverting water therefrom beyond that necessary for use thereon for irrigating and mining purposes; 3d, what action is needed to protect the rights of riparian owners along the waters of said streams in Kansas and Nebraska; and 4th, what measures can be devised to increase the flow of water in these streams during such season.

Of these matters only those embraced under the second and third heads come within your request for an expression of my views.

In reference to the former, I have to state that the title conveyed by the Government carries with it the right to the enjoyment of the water privileges attaching under the common and statute law to the proprietorship of the land. This right is affected by certain provisions of the acts of Congress of July 26, 1866 (14 Stat., 253), July 9, 1870 (16 Stat., 217), and May 10, 1872 (17 Stat., 91), now embodied in sections 2339 and 2340, United States Revised Statutes. These sections read as follows:

SEC. 2339. Whenever by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and the decisions of courts, and the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purposes herein specified is acknowledged and confirmed; but whenever any person, in the construction of any ditch or canal, injures or damages the possession of any settler on the public domain, the party committing such injury or damage shall be liable to the party injured for such injury or damage.

SEC. 2340. All patents granted or pre-emptions or homesteads allowed, shall be subject to any vested and accrued water rights, or rights to ditches and reservoirs used in connection with such water rights as may have been acquired under or recognized by the preceding section.

The foregoing statutes recognize the rights subsisting under the "local customs, laws, and the decisions of courts" to the use of water for mining, agricultural, manufacturing, or other purposes, and enact that the possessors and owners thereof shall be maintained and protected in the same, and the right of way for the construction of "ditches and canals" for the purposes specified is acknowledged and confirmed. All patents granted or pre-emptions or homesteads allowed are made subject to the rights so recognized, acknowledged, and confirmed.

The statutes of Colorado, which provide elaborately for the regulation and protection of such water rights, may be found in the General Statutes, State of Colorado, of 1883, page 560 *et seq.*, and for information on the general subject, Gould on Waters, sections 226 to 240, inclusive, may be consulted.

The "local customs, laws, and decisions of courts," so far as I am able to ascertain, appear to admit of the diversion of water from streams to an extent beyond what is implied in the expression, "necessary for use on the lands fronting on the streams for irrigation and mining purposes." They seem to contemplate the conveying of the water for use beyond the land fronting immediately on the streams, and even for use in reservoirs, for mining, agricultural, manufacturing, and other purposes.

In reference to the inquiry touching the rights of riparian owners, I can only suggest, with the limited data in my possession, that the question, having reference to the vested rights of owners under existing laws, does not appear to be one for legislative or departmental action, and that in case of controversy the courts are open for the adjudication of the rights of such parties, whatever they may be, under the law and the facts of the particular case.

Very respectfully,

S. M. STOCKSLAGER,
Commissioner.

Hon. WILLIAM F. VILAS,
Secretary of the Interior.

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